

**Improving Ventilation and Saving Energy: Final Report
on Indoor Environmental Quality and Energy Monitoring
in Sixteen Relocatable Classrooms**

Appendix

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Tables

Table A-1. Thermal Comfort Results – May 2005, September 2005, November 2005

		Room 13 – 9/19/2005			
AM/PM Time Period	Operative T and RH Acceptable (% of time)	Operative T and RH, and Air Velocity acceptable (%) of time)		Average Indoor Air T (°C)	Average Indoor Air RH (%)
		66.7	0.0	21.3	67.1
AM	AM1	66.7	0.0	21.3	67.1
PM	PM1	40.0	0.0	24.9	46.8
Room 13 - 5/16/2005					
AM	AM1	0.0	0.0	21.1	0.4
PM	PM1	0.0	0.0	20.8	55.5
Room 13 – 12/1/2005					
AM	AM1	0.0%	0.0%	17.8	38.5
PM	PM1	14.3%	0.0%	22.9	42.5
Room 14 - 5/16/2005					
AM/PM Time Period	Operative T and RH, T and RH Acceptable (% of time)	Operative T and RH, and Air Velocity acceptable (%) of time)	Average Indoor Air T (°C)	Average Indoor Air RH (%)	
AM	AM1	50.0	50.0	21.4	50.5
AM	Recess	100.0	100.0	23.5	45.6
PM	PM1	66.7	66.7	23.0	57.0
Room 14 – 9/19/2005					
AM	AM1	33.3	0	22.0	58.1
PM	PM1	77.8	11.1	23.6	49.2
Room 14 - 12/1/2005					
AM	AM1	0.0%	0.0%	16.2	41.7
PM	PM1	0.0%	0.0%	22.0	45.9

Table A-1. Thermal Comfort Results – May 2005, September 2005, November 2005
 (continued).

		Room 15 - 5/16/2005					
AM/PM	Time Period	Operative T and RH		Operative T and RH, and Air Velocity acceptable (% of time)		Average Indoor Air T (°C)	Average Indoor Air RH (%)
		Acceptable (% of time)	Acceptable (% of time)	Average Indoor Air T (°C)	Average Indoor Air RH (%)		
AM	AM1		0.0	0.0	21.0	56.7	
PM	PM1		0.0	0.0	21.6	58.0	
Room 15 – 9/19/2005							
AM	AM1		33.3	0.0	21.1	66.4	
PM	PM1		0.0	0.0	21.9	53.2	
PM	TeacherOnly		0.0	0.0	21.8	53.2	
Room 15 – 12/1/2005							
AM	AM1		0.0%	0.0%	20.1	39.9	
PM	PM1		0.0%	0.0%	20.9	43.6	
PM	TeacherOnly		0.0%	0.0%	20.1	45.5	
Room 16 - 5/16/2005							
AM/PM	Time Period	Operative T and RH		Operative T and RH, and Air Velocity acceptable (% of time)		Average Indoor Air T (°C)	Average Indoor Air RH (%)
		Acceptable (% of time)	Acceptable (% of time)	Average Indoor Air T (°C)	Average Indoor Air RH (%)		
AM	AM1		0.0	0.0	21.1	0.2	
PM	PM1		66.7	66.7	22.8	52.3	
Room 16 – 9/19/2005							
AM	AM1		66.7	33.3	21.8	50.9	
PM	PM1		60.0	60.0	26.7	37.6	
Room 16 – 12/1/2005							
AM	AM1		0.0%	0.0%	20.1	42.0	
PM	PM1		66.7%	50.0%	23.8	41.4	
PM	TeacherOnly		100.0%	100.0%	25.5	38.8	

Table A-1. Thermal Comfort Results – May 2005, September 2005, November 2005
 (continued).

		Room 21 – 9/14/2005				
AM/PM Time Period	Operative T and RH Acceptable (%) of time)	Operative T and RH, and Air Velocity acceptable (%) of time)	Average Indoor Air T (°C)	Average Indoor Air RH (%)		
AM	AM1	0.0	0.0	21.5	39.0	
PM	PM1	50.0	16.7	24.3	39.3	
Room 21 – 11/16/2005						
PM	PM1	0.0%	0.0%	21.5	38.1	
PM	TeacherOnly	0.0%	0.0%	20.9	39.2	
Room 22 – 9/14/2005						
AM/PM Time Period	Operative T and RH Acceptable (%) of time)	Operative T and RH, and Air Velocity acceptable (%) of time)	Average Indoor Air T (°C)	Average Indoor Air RH (%)		
AM	AM1	0.0	0.0	20.7	55.6	
PM	PostRecess	33.3	0.0	22.7	44.1	
PM	PM1	0.0	0.0	20.9	47.5	
Room 22 – 11/16/2005						
AM	AM1	0.0%	0.0%	19.4	50.6	
PM	PM1	0.0%	0.0%	21.9	42.5	
Room 23 – 9/14/2005						
AM/PM Time Period	Operative T and RH Acceptable (%) of time)	Operative T and RH, and Air Velocity acceptable (%) of time)	Average Indoor Air T (°C)	Average Indoor Air RH (%)		
AM	AM1	100.0	66.7	22.6	53.1	
PM	PM1	62.5	25.0	23.2	44.4	
Room 23 – 11/16/2005						
AM	AM1	0.0%	0.0%	20.7	49.0	
PM	PM1	33.3%	33.3%	23.0	48.2	

Table A-1. Thermal Comfort Results – May 2005, September 2005, November 2005
 (continued).

Room 24 – 9/14/2005

AM/PM Time Period		Operative T and RH Acceptable (% of time)	Operative T and RH, and Air Velocity acceptable (% of time)	Average Indoor Air T (°C)	Average Indoor Air RH (%)
AM	AM1	0.0	0.0	20.2	58.0
PM	PM1	0.0	0.0	21.5	47.4
PM	TeacherOnly	0.0	0.0	21.4	44.1
Room 24 – 11/16/2005					
AM	AM1	0.0%	0.0%	18.4	48.5
PM	PM1	50.0%	16.7%	23.0	48.2
PM	TeacherOnly	100.0%	0.0%	23.3	40.2

Room 25 – 9/14/2005

AM/PM Time Period		Operative T and RH Acceptable (% of time)	Operative T and RH, and Air Velocity acceptable (% of time)	Average Indoor Air T (°C)	Average Indoor Air RH (%)
AM	AM2	0.0	0.0	21.4	48.4
PM	Lunch/Recess	0.0	0.0	21.9	44.3
PM	PostRecess	0.0	0.0	22.4	42.9
PM	PM1	0.0	0.0	22.4	44.2
Room 25 – 11/16/2005					
AM	AM1	0.0%	0.0%	17.9	52.8
AM	Recess	0.0%	0.0%	21.1	45.6
AM	PostRecess	0.0%	0.0%	21.5	43.0
AM	AM2	10.0%	0.0%	22.5	41.7
PM	Lunch/Recess	0.0%	0.0%	22.4	39.6
PM	PostRecess	33.3%	0.0%	22.5	37.9
PM	PM1	0.0%	0.0%	22.6	40.4

Table A-1. Thermal Comfort Results – May 2005, September 2005, November 2005
 (continued).

AM/PM	Time Period	Operative T and RH Acceptable (% of time)	Operative T and RH, and Air Velocity acceptable (% of time)	Average Indoor Air T (°C)	Average Indoor Air RH (%)
AM	AM2	66.7	66.7	23.1	55.4
PM	Lunch/Recess	100.0	100.0	24.6	46.0
PM	PostRecess	100.0	100.0	24.8	42.5
PM	PM1	100.0	100.0	25.2	43.6
Room 26 – 11/16/2005					
AM	AM1	0.0%	0.0%	18.3	62.1
AM	Recess	0.0%	0.0%	21.1	56.2
AM	PostRecess	0.0%	0.0%	21.0	50.4
AM	AM2	0.0%	0.0%	22.3	50.0
PM	Lunch/Recess	75.0%	75.0%	22.7	49.7
PM	PostRecess	66.7%	33.3%	22.5	48.6
PM	PM1	0.0%	0.0%	21.3	50.2

Table A-1. Thermal Comfort Results – May 2005, September 2005, November 2005
 (continued).

AM/PM Time Period		Operative T and RH Acceptable (% of time)	Operative T and RH, and Air Velocity acceptable (% of time)	Average Indoor Air T (°C)	Average Indoor Air RH (%)
AM	PostRecess	33.3	0.0	21.8	61.1
AM	AM2	12.5	0.0	22.1	54.4
PM	Lunch/Recess	28.6	0.0	22.4	54.1
PM	PostRecess	33.3	0.0	22.1	56.5
PM	PM1	100.0	0.0	22.5	58.4
Room 35 - 5/16/2005					
AM	AM1	0.0	0.0	21.4	48.3
AM	Recess	33.3	0.0	22.3	59.5
AM	PostRecess	75.0	0.0	22.7	57.0
AM	AM2	37.5	0.0	21.1	60.8
PM	Lunch/Recess	0.0	0.0	21.0	57.4
PM	PostRecess	33.3	0.0	21.9	55.8
PM	PM1	0.0	0.0	20.0	55.4
Room 35 - 9/19/2005					
AM	AM1	0.0%	0.0%	20.1	39.0
AM	Recess	0.0%	0.0%	20.7	37.6
AM	PostRecess	0.0%	0.0%	20.7	37.3
AM	AM2	0.0%	0.0%	22.0	38.7
PM	Lunch/Recess	0.0%	0.0%	21.3	38.6
PM	PostRecess	0.0%	0.0%	21.8	37.8
PM	PM1	0.0%	0.0%	20.7	42.0
Room 35 - 12/1/2005					

Table A-1. Thermal Comfort Results – May 2005, September 2005, November 2005
 (continued).

		Room 36 - 5/16/2005			
AM/PM	Time Period	Operative T and RH Acceptable (% of time)	Operative T and RH, and Air Velocity acceptable (% of time)	Average Indoor Air T (°C)	Average Indoor Air RH (%)
AM	PostRecess	33.3	33.3	22.4	61.2
AM	AM2	100.0	87.5	24.7	51.1
PM	Lunch/Recess	100.0	85.7	23.6	51.8
PM	PostRecess	100.0	66.7	23.8	53.5
PM	PM1	100.0	50.0	23.4	52.8
Room 36 – 9/19/2005					
AM	AM1	100.0	100.0	24.7	50.2
AM	Recess	100.0	100.0	24.4	51.7
AM	PostRecess	100.0	100.0	24.4	52.7
AM	AM2	66.7	100.0	25.3	52.2
PM	Lunch/Recess	100.0	100.0	24.7	51.9
PM	PostRecess	100.0	100.0	24.7	50.7
PM	PM1	100.0	100.0	24.6	50.6
Room 36 – 12/1/2005					
AM	AM1	0.0%	0.0%	21.4	34.9
AM	Recess	0.0%	0.0%	21.6	33.8
AM	PostRecess	0.0%	0.0%	21.5	33.7
AM	AM2	12.5%	0.0%	22.7	34.4
PM	Lunch/Recess	28.6%	0.0%	23.0	33.5
PM	PostRecess	0.0%	0.0%	22.9	33.4
PM	PM1	100.0%	66.7%	23.6	34.0

Table A-2. VOC Concentrations (ppb) at School S1

Compound	35			36			Outside					
	Avg	(Stdev)	Min	Max	Avg	(Stdev)	Min	Max	Avg	(Stdev)	Min	Max
1-Butanol	1.8	(1.3)	0.56	3.2	3.5	(2.5)	0.59	5.0	1.1	(0.85)	0.54	1.7
2-(2-Butoxyethoxy)ethanol	6.5	(3.6)	4.3	11	4.3	(0.14)	4.2	4.5			4.3	4.3
2-Butoxyethanol	3.0	(0.67)	2.2	3.5	5.9	(4.8)	2.2	11	0.86	(0.52)	0.54	1.5
2-Ethyl-1-hexanol	1.2	(1.1)	0.57	2.4	0.95	(0.65)	0.56	1.7			0.59	0.59
2-Propanol	16	(24)	0.0	44	3.7	(4.0)	0.0	7.9	0.74	(1.0)	0.0	1.5
BHT	0.29	(0.00)	0.29	0.29	0.38	(0.16)	0.28	0.57			0.29	0.29
DPGME	1.7	(0.01)	1.7	1.7	1.7	(0.02)	1.7	1.7				
Ethanol	94	(76)	13	164	52	(42)	27	101	3.5	(5.0)	0.0	7.0
Phenol	4.0	(0.96)	2.9	4.8	3.1	(0.80)	2.3	3.9	6.9	(2.5)	4.6	9.5
Propylene glycol	29		29	29			16	16	16			
Benzaldehyde	6.1	(2.5)	3.8	8.7	5.8	(2.1)	4.3	8.1	28	(10)	18	39
Hexanal	1.3	(6.6)	-3.9	8.7	2.5	(11)	-5.2	15	-2.0	(2.8)	-4.8	0.75
Octanal	2.3	(2.0)	0.49	4.5	2.1	(4.6)	-1.2	7.3	0.95	(2.1)	-1.5	2.2
Pentanal	0.19	(2.8)	-1.9	3.3	1.0	(4.2)	-2.0	5.8	-1.4	(0.78)	-2.0	-0.85
n-Decane	-0.09	(0.36)	-0.42	0.29	-0.05	(0.71)	-0.77	0.64	-0.31	(0.69)	-1.1	0.27
n-Dodecane	0.55	(0.23)	0.29	0.70	0.54	(0.13)	0.44	0.63	0.29	(0.0)	0.29	0.29
n-Nonane	0.47	(0.16)	0.29	0.58	0.65	(0.30)	0.47	1.0	0.32	(0.27)	0.0	0.48
n-Undecane	0.63	(0.05)	0.59	0.68	0.69	(0.20)	0.46	0.85	0.40	(0.21)	0.27	0.65
1,2,4-Trimethylbenzene	1.5	(0.61)	0.77	1.9	1.3	(0.65)	0.56	1.7	1.1	(0.66)	0.31	1.6
m-Xylene	6.5	(3.8)	2.8	10	5.8	(3.4)	2.2	9.0	5.0	(2.9)	1.7	7.4
Naphthalene	0.19	(0.17)	0.0	0.29	0.19	(0.16)	0.0	0.29	0.19	(0.16)	0.0	0.29
Toluene	13	(6.5)	6.0	18	13	(5.8)	6.3	17	11	(5.7)	4.4	15
Butyl acetate	1.1	(0.29)	0.83	1.4	2.3	(1.9)	0.93	4.4	0.82	(0.05)	0.79	0.87
TMPD-DIB	3.2	(2.1)	1.9	5.6	3.9	(1.4)	2.2	4.8	0.15	(0.21)	0.0	0.29
TMPD-MIB	3.4	(2.2)	1.8	5.8	3.3	(1.7)	2.1	5.2	0.58	(0.01)	0.57	0.59
1,4-Dichlorobenzene	3.1	(2.1)	1.3	5.5	6.1	(9.2)	0.60	17	0.28	(0.01)	0.27	0.29
Dichloromethane	0.07	(4.5)	-5.0	3.6	-0.87	(3.6)	-4.9	2.2	-1.2	(3.3)	-5.0	1.3
Tetrachloroethene	0.41	(0.21)	0.29	0.66	0.94	(0.98)	0.28	2.1	0.33	(0.09)	0.27	0.43
2-Butanone	3.2	(2.5)	1.6	6.1	3.1	(2.4)	1.3	5.8	2.5	(1.3)	1.6	4.0
2-Propanone	2.1	(14)	-12	15	1.4	(12)	-7.5	16	-7.7	(6.7)	-12	0.0
4-Methyl-2-pentanone	2.9	(2.9)	0.80	4.9	1.1	(0.13)	0.96	1.1			0.72	0.72
Acetophenone	1.7	(0.16)	1.6	1.9	1.8	(0.34)	1.5	2.1	22	(8.6)	16	32
Benzothiazole	0.83	(0.51)	0.29	1.3	0.95	(0.30)	0.61	1.1	0.19	(0.16)	0.0	0.29
D5 Siloxane	24	(15)	9.8	40	59	(72)	14	142	2.4	(1.1)	1.2	3.4
1-Methyl-2-pyrrolidinone	0.29		0.29	0.29			0.28	0.28	0.28			
Caprolactam	2.8	(1.2)	1.7	4.1	1.8	(1.1)	0.59	2.9				
d-Limonene	1.5	(0.98)	0.81	2.6	2.3	(2.1)	0.97	4.7	0.19	(0.17)	0.0	0.29
Acetaldehyde	12	(2.7)	9.1	14	13	(2.5)	11	16	6.2	(3.7)	1.9	8.5
Formaldehyde	26	(12)	14	38	20	(8.5)	11	27	4.4	(4.9)	0.97	10

Table A-3. VOC Concentrations (ppb) at School N2

Compound	Room 25			Room 26			Outside					
	Avg	(Stdev)	Min	Max	Avg	(Stdev)	Min	Max	Avg	(Stdev)	Min	Max
1-Butanol	0.89	(0.45)	0.57	1.2	6.4	(4.5)	3.4	12				
2-(2-Butoxyethoxy)ethanol	19	(21)	4.3	35	8.0	(4.6)	4.0	13				
2-Butoxyethanol	2.0	(0.61)	1.4	2.6	76	(80)	27	170	0.68	(0.13)	0.58	0.77
2-Ethyl-1-hexanol	0.81	(0.42)	0.57	1.3	2.7	(0.89)	1.8	3.6				
2-Propanol	3.3	(0.48)	3.0	3.7	87	(37)	48	123	1.7	(0.33)	1.5	1.9
BHT	0.28	(0.02)	0.26	0.29	0.53	(0.25)	0.28	0.78			0.38	0.38
DPGME	14	(3.8)	10	17	40	(12)	30	54				
Ethanol	0.31	(0.23)	9.8	56			23	2300	2300	0.12	(0.09)	2.9
Ethylene glycol			12	12	12							
Phenol	0.33	(0.30)	0.0	0.59	11	(9.5)	5.1	22	3.8	(1.9)	2.0	5.7
Propylene glycol					29	(24)	8.0	55				
Benzaldehyde	2.0	(1.6)	0.40	3.5	6.9	(1.8)	4.9	8.2	15	(7.0)	9.1	23
Hexanal	3.0	(1.4)	2.0	4.6	15	(1.2)	14	16	0.63	(0.84)	-0.22	1.5
Octanal	1.4	(0.48)	1.1	2.0	2.8	(0.48)	2.3	3.2	0.28	(0.69)	-0.51	0.75
Pentanal	0.28	(0.29)	0.0	0.57	2.5	(0.71)	1.8	3.2	0.29	(0.41)	0.0	0.58
n-Decane	-1.1	(0.05)	-1.1	-1.1	0.20	(1.2)	-1.2	1.1	-1.1	(0.07)	-1.2	-1.1
n-Dodecane	0.95	(1.9)	-0.52	3.1	4.6	(1.3)	3.1	5.6	1.1	(2.1)	-0.37	2.6
n-Nonane	0.32	(0.10)	0.25	0.44	0.39	(0.21)	0.26	0.63	0.29	(0.0)	0.29	0.29
n-Undecane	0.59	(0.56)	0.25	1.2	2.2	(1.1)	1.1	3.3	0.29	0.29	0.29	0.29
1,2,4-Trimethylbenzene	0.54	(0.46)	0.26	1.1	1.3	(0.94)	0.28	2.2	0.50	(0.28)	0.29	0.82
m-Xylene	1.6	(1.5)	0.64	3.3	3.1	(2.6)	1.5	6.2	1.3	(1.3)	0.29	2.8
Naphthalene	0.18	(0.16)	0.0	0.29	1.1	(1.1)	0.28	2.3	0.15	(0.21)	0.0	0.29
Toluene	6.4	(5.0)	1.4	11	9.8	(8.4)	4.3	19	5.4	(3.7)	1.3	8.5
Butyl acetate	3.3	(1.5)	1.8	4.8	8.5	(9.0)	0.95	18	0.53	(0.41)	0.29	1.0
TMPD-DIB	2.1	(0.47)	1.5	2.4	7.5	(1.5)	6.6	9.2	0.29	0.29	0.29	0.29
TMPD-MIB	3.3	(1.6)	1.6	4.9	14	(3.2)	12	18				
1,4-Dichlorobenzene	0.34	(0.07)	0.29	0.39	1.7	(0.84)	1.1	2.7			0.29	0.29
Dichloromethane	0.41	(0.72)	0.0	1.2	0.50	(0.86)	0.0	1.5	0.64	(1.1)	0.0	1.9
Tetrachloroethene	0.28	(0.02)	0.26	0.29	0.27	(0.01)	0.27	0.28	0.32	(0.05)	0.29	0.38
2-Butanone	0.90	(0.62)	0.51	1.6	1.4	(0.47)	0.88	1.7	0.98	(0.53)	0.58	1.6
2-Propanone	9.2	(16)	0.0	27	28		28	28	4.1	(7.6)	-3.4	12
4-Methyl-2-pentanone	5.5	(2.9)	2.6	8.4	11	(9.3)	1.3	20	0.71	(0.73)	0.29	1.6
Acetophenone	0.43	(0.79)	-0.17	1.3	1.5	(1.5)	0.23	3.2	10	(4.6)	6.5	15
Benzothiazole	0.10	(0.17)	0.0	0.29	0.91	(0.13)	0.77	1.0	0.10	(0.17)	0.0	0.29
D5 Siloxane	11	(4.1)	7.1	15	26	(19)	7.6	45	0.39	(0.68)	0.0	1.2
1-Methyl-2-pyrrolidinone					0.51	(0.21)	0.28	0.70				
Caprolactam	0.56	(0.02)	0.53	0.57	2.1	(0.32)	1.8	2.4				
d-Limonene	1.1	(0.42)	0.81	1.6	7.9	(3.2)	4.4	11	0.15	(0.21)	0.0	0.29
Acetaldehyde	4.7	(1.1)	3.4	5.5	10	(4.5)	5.7	15	4.5	(1.9)	2.8	6.5
Formaldehyde	8.9	(1.4)	7.4	10	21	(5.7)	15	26	2.7	(1.2)	1.7	4.1

Table A-4. VOC Concentrations (ppb) at School N1.

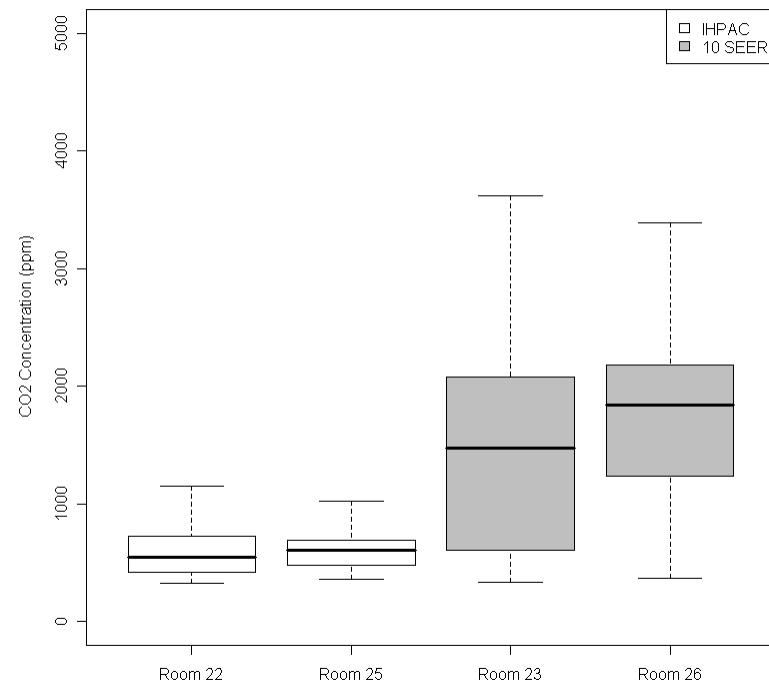
Compound	Room 21			Room 22			Room 23			Room 24			Outside							
	Avg	(Stdev)	Min	Max	Avg	(Stdev)	Min	Max	Avg	(Stdev)	Min	Max	Avg	(Stdev)	Min	Max				
1-Butanol	3.9	(2.9)	2.0	7.3	2.7	(3.1)	0.53	6.2	10	(9.2)	3.1	20	1.7	(0.33)	1.4	2.0				
2-(2-Butoxyethoxy)ethanol	4.3	4.3	4.3		4.2	(0.17)	4.0	4.3		4.3	4.3	4.3	4.4	4.4	4.4					
2-Butoxyethanol	18	(17)	6.0	38	43	(57)	3.3	110	36	(20)	19	57	8.3	(3.0)	5.8	12				
2-Ethyl-1-hexanol	2.5	(0.92)	1.7	3.5	0.56	(0.03)	0.53	0.58	2.1	(0.58)	1.5	2.6	0.57	(0.03)	0.54	0.59				
2-Propanol	7.7	(4.0)	3.7	12	14	(20)	1.4	38	4.4	(0.19)	4.2	4.5	14	(19)	1.4	35				
BHT	0.47	(0.21)	0.28	0.70	0.73	(0.63)	0.27	1.5	2.4	(1.5)	1.4	4.1	0.44	(0.28)	0.27	0.77				
DPGME	15	(22)	1.7	40	5.6	(4.3)	1.7	10	9.6	(14)	1.6	26	1.7	(0.07)	1.6	1.8				
Ethanol	120	(76)	56	200	17	(9.7)	7.5	27	68	(78)	18	160	96	(127)	6.4	190				
Ethylene glycol											14	14	14							
Phenol	3.2	(0.47)	2.7	3.6	1.6	(0.26)	1.4	1.9	2.8	(1.0)	1.6	3.6	1.6	(0.36)	1.4	2.1				
Propylene glycol	2.7	2.7	2.7		16	16	16		2.7	2.7	2.7	2.7		2.6	(0.39)	2.3	2.8			
Benzaldehyde	4.2	(2.1)	2.2	6.4	2.5	(0.46)	2.2	3.1	4.1	(1.3)	2.7	5.1	2.0	(1.2)	0.60	2.7	10	(1.0)	9.8	11
Hexanal	14	(4.7)	8.3	17	5.9	(2.4)	3.2	7.7	12	(0.43)	11	12	4.5	(1.4)	3.6	6.2	0.06	(0.06)	0.01	0.10
Octanal	3.2	(0.37)	2.9	3.6	1.8	(0.04)	1.7	1.8	3.5	(1.0)	2.4	4.4	1.7	(0.19)	1.6	2.0	0.48	(0.11)	0.40	0.56
Pentanal	2.4	(0.34)	2.1	2.8	0.76	(0.51)	0.30	1.3	2.1	(0.70)	1.6	2.9	0.46	(0.41)	0.0	0.79		0.0	0.0	0.0
n-Decane	0.85	(0.73)	0.33	1.4	-1.1	(0.06)	-1.2	-1.1	0.59	(0.89)	-0.32	1.5	-1.1	(0.06)	-1.2	-1.1		-1.1	-1.1	-1.1
n-Dodecane	4.5	(5.3)	0.74	8.2	0.68	(1.7)	-0.52	1.9	1.8	(0.03)	1.8	1.8	0.58	0.58	0.58		-0.39	-0.39	-0.39	
n-Nonane	0.58	(0.42)	0.28	0.87	0.28	(0.01)	0.27	0.29	0.54	(0.34)	0.30	0.78	0.29	(0.01)	0.28	0.29		0.30	0.30	0.30
n-Undecane	2.3	(3.0)	0.27	5.8	0.91	(0.88)	0.29	1.5	1.7	(0.44)	1.2	2.0	0.57	(0.18)	0.44	0.70				
1,2,4-Trimethylbenzene	1.3	(1.4)	0.27	2.9	0.43	(0.26)	0.27	0.73	1.1	(0.59)	0.73	1.8	0.41	(0.23)	0.27	0.67		0.30	0.30	0.30
m-Xylene	4.3	(4.3)	1.5	9.3	2.1	(2.4)	0.65	4.9	3.4	(1.3)	2.6	4.9	1.5	(0.53)	0.95	2.0	0.87	(0.86)	0.26	1.5
Naphthalene	0.18	(0.16)	0.0	0.28	0.19	(0.16)	0.0	0.29	0.19	(0.17)	0.0	0.30	0.19	(0.16)	0.0	0.29		0.30	0.30	0.30
Toluene	12	(12)	2.0	25	4.3	(3.5)	1.2	8.1	14	(8.3)	5.3	22	3.7	(2.2)	1.7	6.0	2.6	(2.8)	0.56	4.5
Butyl acetate	1.0	(0.28)	0.78	1.3	21	(12)	10	33	85	(135)	3.2	240	13	(3.2)	10	16	0.26	0.26	0.26	
TMPD-DIB	2.7	(0.46)	2.1	2.9	2.0	(0.13)	1.8	2.1	4.3	(0.19)	4.1	4.4	2.2	(0.39)	1.9	2.7				
TMPD-MIB	2.5	(1.2)	1.8	3.9	6.2	(2.7)	4.0	9.2	9.7	(2.5)	7.7	13	3.1	(0.41)	2.8	3.6				
1,4-Dichlorobenzene	0.28	(0.01)	0.27	0.28	0.75	(0.08)	0.70	0.84	1.7	(1.3)	0.28	2.5	0.64	(0.30)	0.29	0.83				
Dichloromethane	1.5	(2.5)	0.0	4.4	0.67	(0.95)	0.0	1.3	2.0	(3.5)	0.0	6.1	0.45	(0.79)	0.0	1.4		0.0	0.0	0.0
Tetrachloroethene	0.96	(0.73)	0.27	1.7	0.29	(0.0)	0.29	0.29	0.74	(0.54)	0.30	1.3	0.28	(0.01)	0.27	0.29		0.30	0.30	0.30
2-Butanone	1.3	(0.82)	0.57	2.2	0.70	(0.26)	0.53	1.0	1.5	(0.03)	1.5	1.6	0.78	(0.34)	0.58	1.2	0.88	(0.50)	0.52	1.2
2-Propanone	31	(26)	5.3	56	9.6	(5.1)	3.7	13	15	(15)	-1.9	26	2.6	(2.8)	0.54	4.6	-1.9	(2.7)	-3.8	0.0
4-Methyl-2-pentanone	0.08	(0.01)	0.67	0.89	4.2	(2.4)	19	68	15	(24)	5.7	430	2.4	(0.53)	19	29	0.05	(0.02)	0.30	0.64
Acetophenone	0.80	(0.19)	0.65	1.0	0.90	(0.13)	0.82	1.1	1.4	(0.75)	0.59	2.1	-0.06	(1.2)	-1.3	1.1	5.2	(0.78)	4.7	5.8
Benzothiazole	1.2	(0.12)	1.0	1.3	0.37	(0.07)	0.29	0.43	1.2	(0.09)	1.1	1.3	0.34	(0.06)	0.29	0.40		0.0	0.0	0.0
D5 Siloxane	4.2	(0.53)	3.8	4.5	98	(54)	38	140	200	(130)	108	290	44	(32)	8.5	70	0.77	(1.1)	0.0	1.5
1-Methyl-2-pyrrolidinone	13	(2.9)	10	16	0.29	0.29	0.29	0.29	0.61	(0.46)	0.28	0.93	0.28	(0.01)	0.27	0.28				
Caprolactam	0.56	(0.02)	0.54	0.57	0.56	(0.03)	0.53	0.58	0.57	(0.03)	0.54	0.59	0.57	(0.03)	0.54	0.59				
d-Limonene	1.7	(0.60)	1.0	2.2	15	(22)	2.3	40	86	(100)	7.1	200	12	(13)	2.4	26		0.30	0.30	0.30
Acetaldehyde	8.6	(2.2)	7.2	11	4.2	(2.8)	1.1	6.5	7.5	(1.7)	5.5	8.8	7.8	(5.4)	4.4	14	1.9	(2.3)	0.29	3.6
Formaldehyde	26	(7.1)	22	35	10	(1.8)	8.2	11	21	(4.6)	16	25	12	(1.3)	11	13	1.8	(0.90)	1.2	2.5

Table A-5. VOC Concentrations (ppb) at School S2.

Compound	Room T13				Room T14				Room T15				Room T16				Outside				
	Avg	(Stdev)	Min	Max	Avg	(Stdev)	Min	Max	Avg	(Stdev)	Min	Max	Avg	(Stdev)	Min	Max	Avg	(Stdev)	Min	Max	
1-Butanol	9.4	(6.5)	2.4	15	4.1	(2.2)	1.7	6.0	1.7	(1.5)	0.57	3.4	2.0	(1.7)	0.61	3.9	0.88	(0.52)	0.51	1.3	
2-(2-Butoxyethoxy)ethanol	6.3	(3.7)	4.0	11	20	(15)	10	38	4.1	(2.8)	4.0	4.5	14	(4.6)	10	19					
2-Butoxyethanol	6.8	(3.8)	4.4	11	11	(3.2)	8.1	14	4.1	(0.63)	3.5	4.8	45	(27)	14	67	0.83	(0.51)	0.51	1.4	
2-Ethyl-1-hexanol	1.0	(0.12)	0.90	1.1	3.1	(0.41)	2.7	3.4	1.5	(0.23)	1.4	1.8	2.2	(0.87)	1.4	3.1	0.91	(0.57)	0.57	1.6	
2-Propanol	2.3	(1.5)	1.3	4.0	12	(8.2)	4.6	21	2.0	(2.5)	0.0	4.8	3.0	(4.1)	0.0	7.7	0.72	(1.0)	0.0	1.4	
BHT	0.60	(0.31)	0.27	0.88	1.8	(0.82)	0.90	2.4	0.42	(0.16)	0.26	0.58	0.44	(0.28)	0.26	0.76			0.30	0.30	0.30
DPGME	1.6	(0.07)	1.6	1.7	1.6	(0.06)	1.5	1.6	1.6	(0.07)	1.6	1.7	1.7	(0.14)	1.6	1.8					
Ethanol	1.7	(1.1)	5.0	27	35	(30)	124	690	1.9	(2.5)	0.0	47	5.0	(3.7)	11	85	1.00	(0.38)	6.3	14	
Phenol	4.6	(1.5)	3.5	6.3	6.8	(2.9)	3.8	9.7	3.4	(1.4)	1.9	4.7	6.1	(3.3)	2.6	9.2	7.2	(4.4)	3.7	12	
Propylene glycol	11	11	11	11	15	(18)	2.7	36		10	10	10	7.3	(6.2)	2.9	12					
Benzaldehyde	5.0	(2.5)	2.5	7.5	6.7	(2.0)	4.4	8.1	4.7	(2.1)	2.4	6.6	6.1	(3.5)	2.8	9.7	30	(15)	17	46	
Hexanal	-0.19	(4.1)	-3.5	4.4	11	(6.8)	4.0	18	-0.92	(3.2)	-3.8	2.5	3.3	(0.74)	2.8	4.1	-1.8	(2.6)	-4.2	0.97	
Octanal	1.3	(1.2)	0.13	2.5	6.1	(1.6)	4.9	7.9	0.84	(1.7)	-1.1	2.2	4.5	(3.2)	2.3	8.2	1.2	(1.2)	-0.20	2.0	
Pentanal	-0.23	(2.0)	-1.9	2.0	3.1	(2.6)	1.0	6.0	-0.50	(1.5)	-1.9	1.2	1.1	(0.85)	0.14	1.8	-0.77	(1.2)	-1.9	0.48	
n-Decane	-0.15	(0.52)	-0.74	0.27	0.45	(0.40)	0.01	0.78	-0.19	(0.51)	-0.74	0.27	0.33	(0.06)	0.26	0.38	-0.32	(0.67)	-1.1	0.26	
n-Dodecane	0.50	(0.20)	0.27	0.62	1.2	(0.58)	0.68	1.8	0.27	(0.01)	0.26	0.28	3.4	(3.1)	1.3	5.6	0.28	(0.03)	0.24	0.30	
n-Nonane	0.63	(0.44)	0.27	1.1	0.61	(0.23)	0.39	0.85	0.49	(0.29)	0.27	0.82	0.53	(0.24)	0.26	0.69	0.36	(0.13)	0.26	0.51	
n-Undecane	0.66	(0.15)	0.53	0.82	1.1	(0.43)	0.74	1.6	0.46	(0.21)	0.27	0.68	0.99	(0.63)	0.26	1.4	0.42	(0.25)	0.27	0.71	
1,2,4-Trimethylbenzene	1.3	(0.88)	0.29	1.9	2.4	(2.0)	0.54	4.6	1.2	(0.75)	0.30	1.6	1.7	(1.4)	0.35	3.2	0.93	(0.85)	0.0	1.7	
m-Xylene	5.9	(4.2)	1.5	10.0	12	(12)	2.6	26	5.5	(3.6)	1.5	8.5	8.4	(8.9)	1.8	19	4.8	(3.1)	1.3	6.7	
Naphthalene	0.19	(0.16)	0.0	0.29	0.65	(0.19)	0.47	0.85	0.18	(0.16)	0.0	0.28	0.19	(0.17)	0.0	0.31	0.18	(0.16)	0.0	0.29	
Toluene	14	(8.5)	4.1	20	28	(16)	16	46	13	(8.2)	4.2	20	18	(12)	5.1	29	27	(34)	3.6	66	
Butyl acetate	0.93	(0.07)	0.88	1.0	2.0	(0.84)	1.4	3.0	1.1	(0.47)	0.74	1.7	4.7	(4.3)	1.5	9.6	0.71	(0.07)	0.64	0.77	
TMPD-DIB	8.8	(1.8)	7.4	11	5.9	(0.34)	5.6	6.2	2.5	(0.34)	2.2	2.9	10	(5.3)	4.8	15	0.19	(0.16)	0.0	0.29	
TMPD-MIB	3.3	(0.84)	2.6	4.3	7.9	(4.4)	3.8	13	2.8	(1.4)	1.7	4.4	5.6	(2.2)	3.1	7.3	0.59	(0.02)	0.57	0.60	
1,4-Dichlorobenzene	1.3	(0.63)	0.91	2.1	5.3	(4.4)	1.9	10	0.63	(0.38)	0.28	1.0	6.9	(4.5)	3.1	12	0.28	(0.02)	0.26	0.30	
Dichloromethane	-2.3	(3.3)	-4.7	0.0	-0.59	(3.6)	-4.7	1.7	-2.3	(3.2)	-4.6	0.0	-1.2	(3.4)	-5.0	1.3	-1.3	(3.4)	-5.2	1.2	
Tetrachloroethylene	0.46	(0.27)	0.27	0.77	0.56	(0.27)	0.25	0.74	0.39	(0.30)	0.16	0.73	0.18	(0.16)	0.0	0.29	0.35	(0.41)	0.0	0.80	
2-Butanone	3.0	(2.7)	1.3	6.1	3.5	(2.7)	1.7	6.7	3.0	(2.7)	1.3	6.1	2.3	(1.5)	1.2	4.0	2.5	(1.4)	1.6	4.1	
2-Propanone	-3.8	(3.6)	-7.2	0.0	12	(6.2)	7.7	16	-10	(12)	-19	-1.7	4.8	(22)	-15	28	1.3	(9.3)	-7.2	11	
4-Methyl-2-pentanone	0.98	(0.06)	0.93	1.0	1.5	(0.12)	1.4	1.6	0.97	(0.97)	0.28	1.7	6.1	(6.4)	0.83	13	0.87	0.87	0.87	0.87	
Acetophenone	1.7	(1.1)	0.78	3.0	3.9	(0.79)	3.2	4.7	2.0	(1.1)	0.69	2.7	4.1	(1.0)	3.2	5.3	20	(15)	8.6	36	
Benzothiazole	1.2	(0.59)	0.82	1.9	2.3	(0.79)	1.7	3.2	0.89	(0.25)	0.72	1.2	1.9	(1.2)	1.1	3.2	0.19	(0.16)	0.0	0.29	
D5 Siloxane	62	(51)	21	118	59	(48)	11	110	35	(8.2)	28	44	82	(58)	41	123	1.7	(0.73)	1.1	2.5	
1-Methyl-2-pyrrolidinone	0.28	(0.01)	0.27	0.29	0.37	(0.17)	0.27	0.56	0.27	(0.01)	0.26	0.27	0.28	(0.02)	0.26	0.29					
Caprolactam	1.3	(0.64)	0.57	1.7	1.3	(0.76)	0.53	2.1	0.80	(0.43)	0.53	1.3	1.9	(0.40)	1.4	2.2					
d-Limonene	1.7	(0.66)	1.3	2.5	17	(14)	7.0	34	1.5	(0.71)	0.79	2.2	2.4	(1.7)	0.77	4.1	0.20	(0.17)	0.0	0.30	
Acetaldehyde	10	(5.8)	4.4	16	19	(2.2)	16	21	7.8	(3.1)	4.3	9.9	14	(8.2)	5.0	20	7.8	(4.0)	3.3	11	
Formaldehyde	18	(6.3)	13	25	31	(2.2)	28	33	18	(4.6)	14	23	25	(6.9)	18	32	5.9	(3.4)	2.9	9.7	

Figures

Northern California Winter 2004 CO₂ Concentration



Southern California Winter 2004 CO₂ Concentration

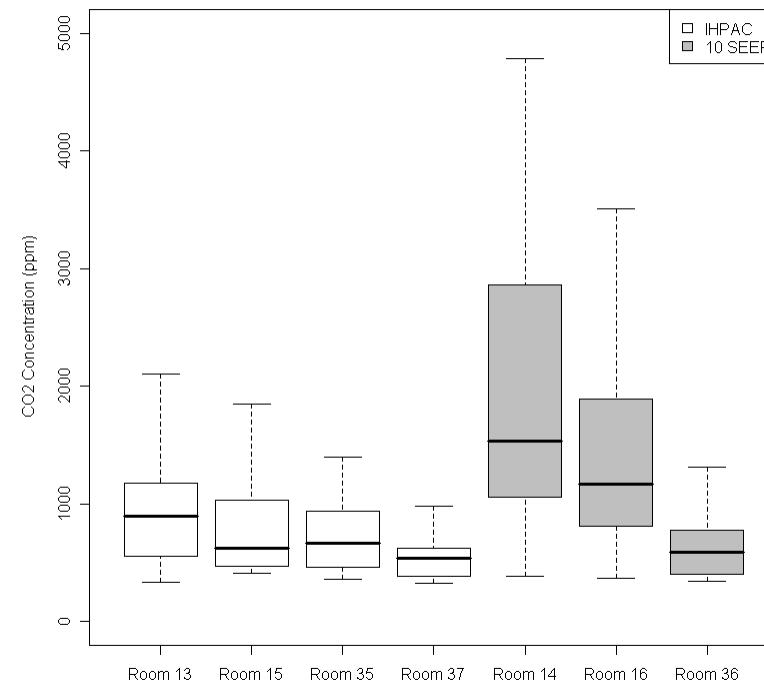
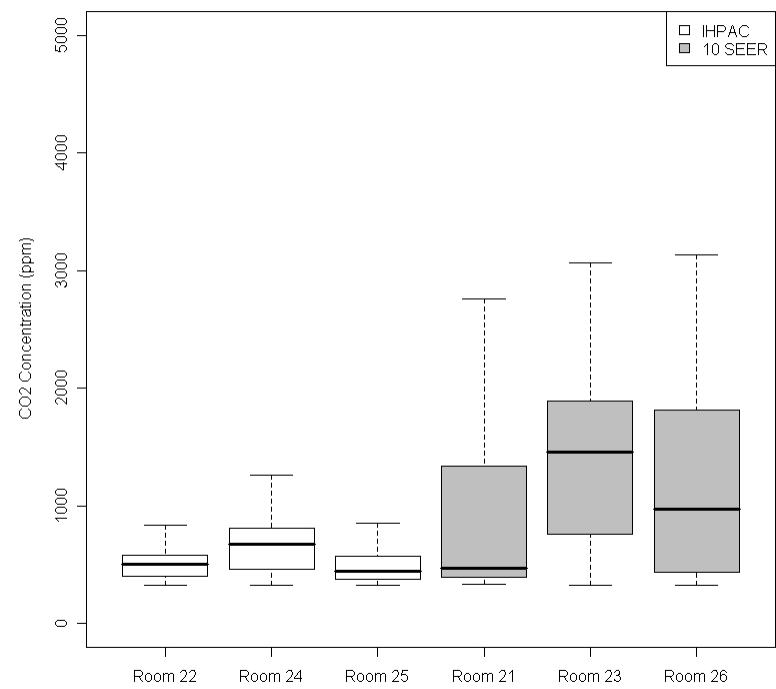


Figure A-1. CO₂ Concentrations (Fuji) For Winter 2004

Northern California Spring 2005 CO₂ Concentration



Southern California Spring 2005 CO₂ Concentration

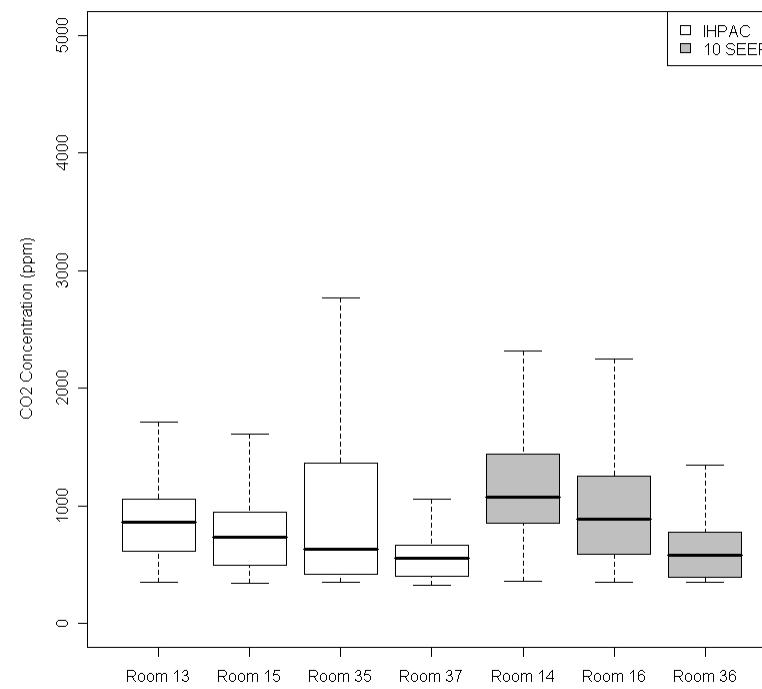
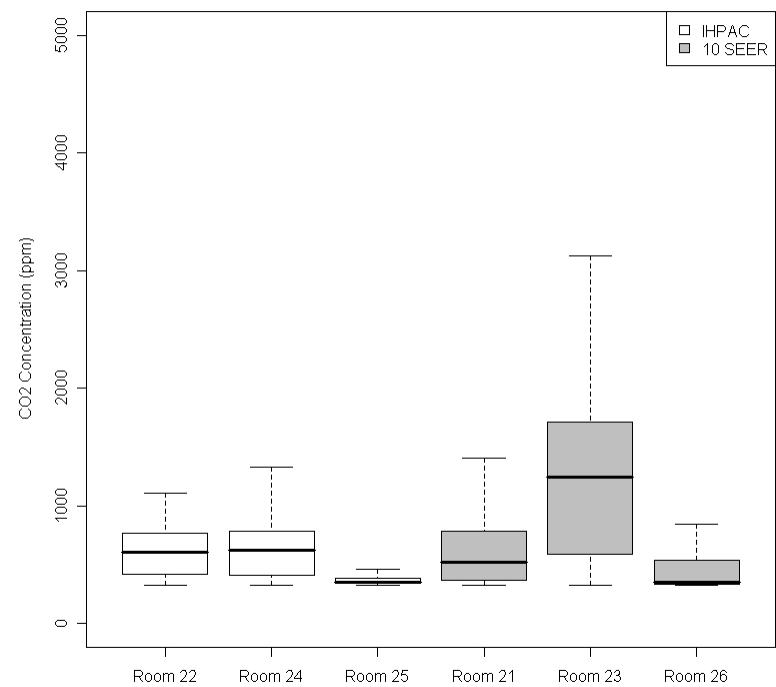


Figure A-2. CO₂ Concentrations (Fuji) for Spring 2005

Northern California Summer 2005 CO₂ Concentration



Southern California Summer 2005 CO₂ Concentration

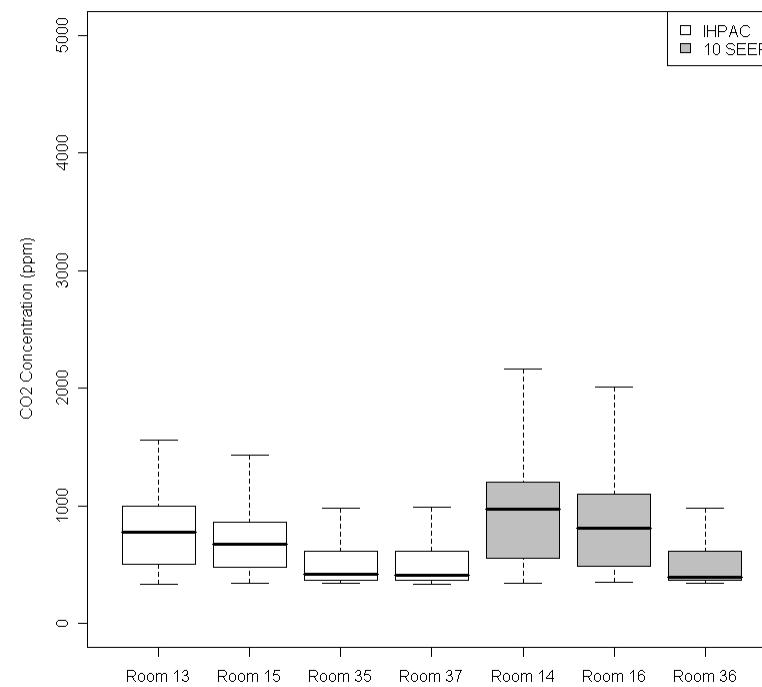
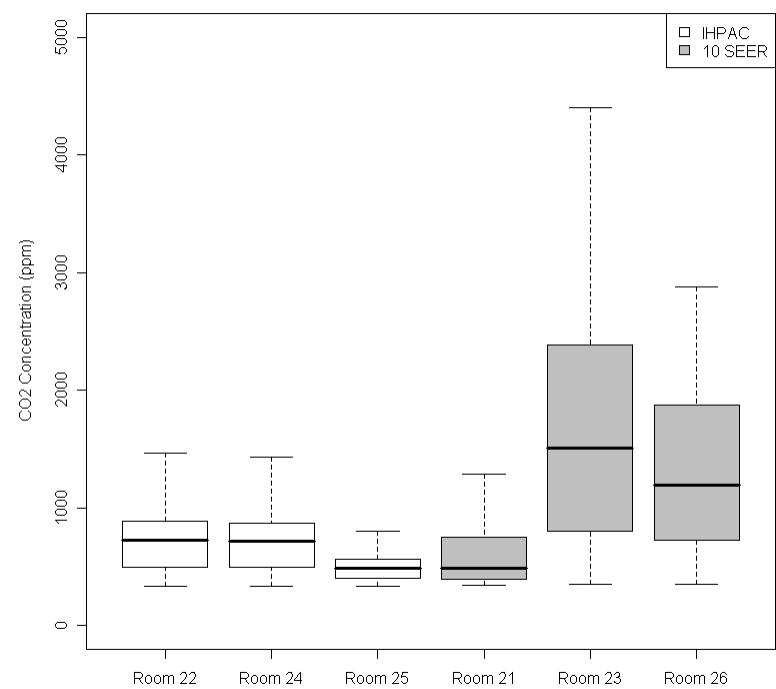


Figure A-3. CO₂ Concentrations (Fuji) for Summer 2005

Northern California Fall 2005 CO₂ Concentration



Southern California Fall 2005 CO₂ Concentration

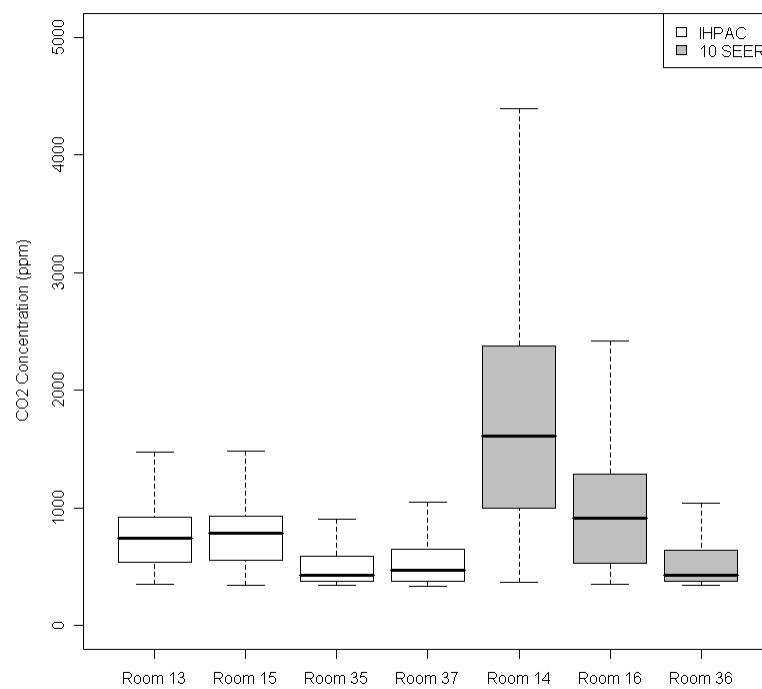


Figure A-4. CO₂ Concentrations (Fuji) for Fall 2005.

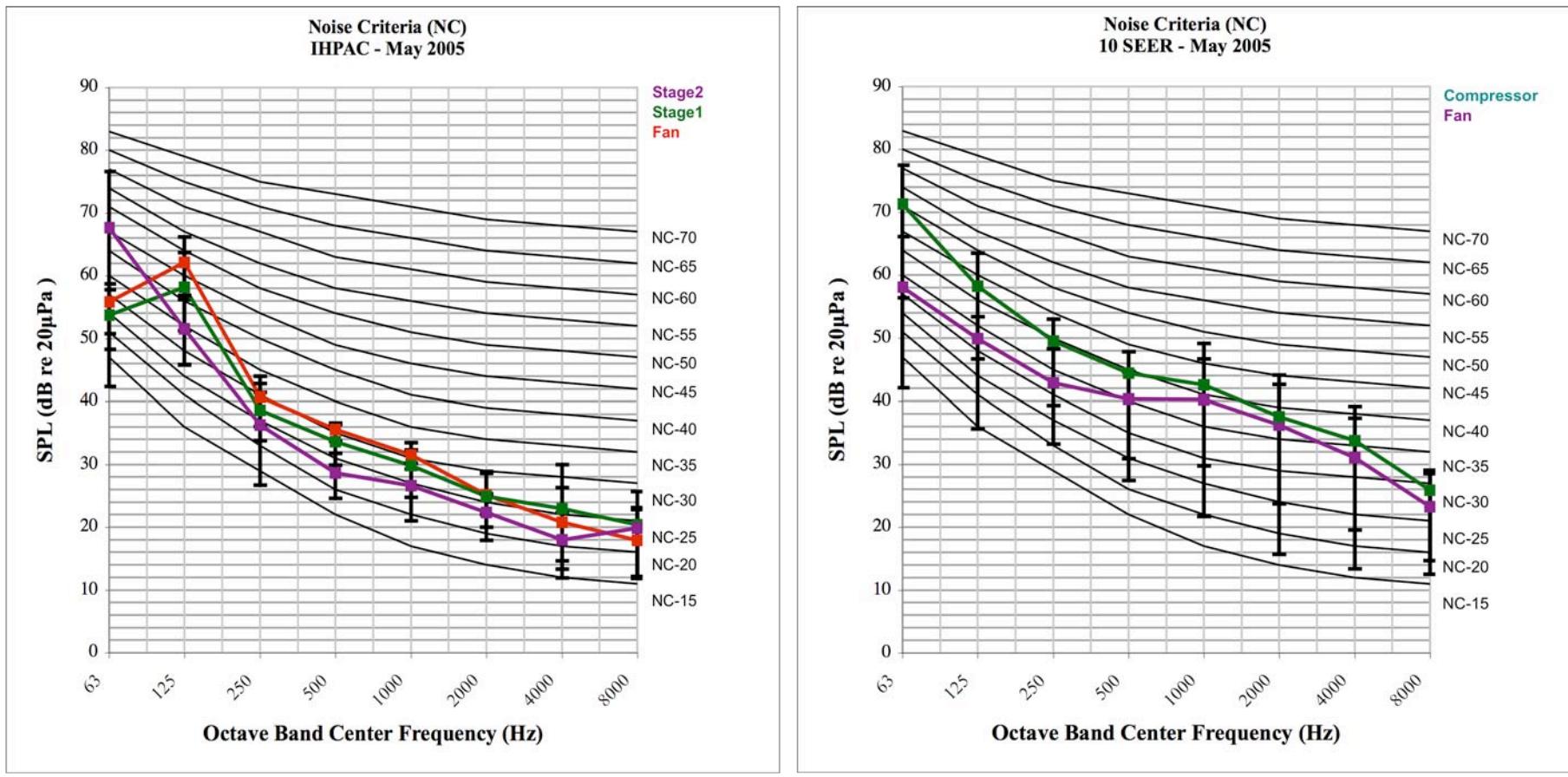


Figure A-5. Acoustic noise octave band distributions for average of six 10 SEER and ten IHPAC systems studied in Northern and Southern California in Spring 2005 operated with fan only and fan plus compressor modes. The error bars presented represent the minimum and maximum measured noise levels across the set of HVAC systems. Measurements were collected centered on the HVAC return plenum grille at a distance of 10 feet and at a height of 5 feet from the floor.

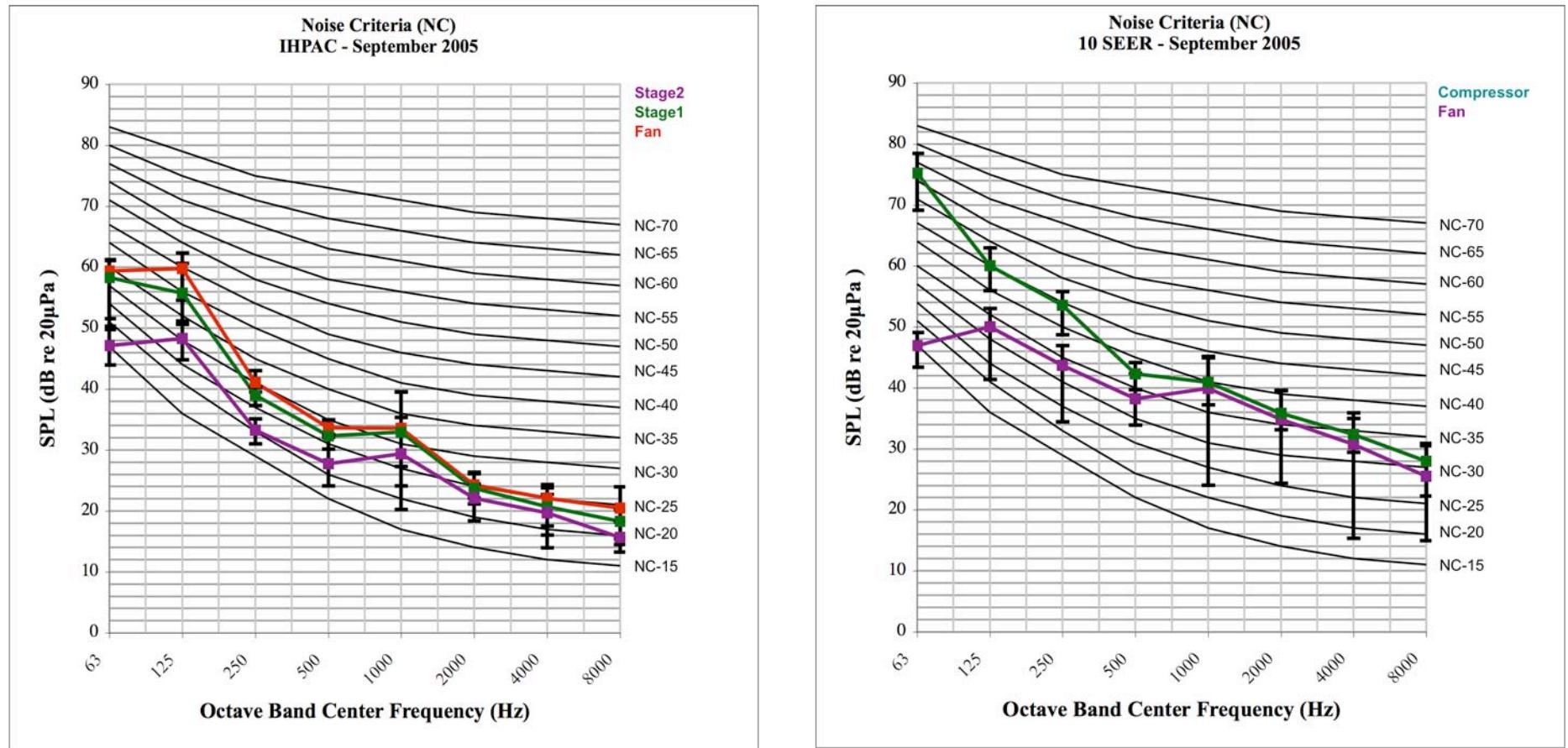


Figure A-6. Acoustic noise octave band distributions for average of six 10 SEER and ten IHPAC systems studied in Northern and Southern California in Summer 2005 operated with fan only and fan plus compressor modes. The error bars presented represent the minimum and maximum measured noise levels across the set of HVAC systems. Measurements were collected centered on the HVAC return plenum grille at a distance of 10 feet and at a height of 5 feet from the floor.

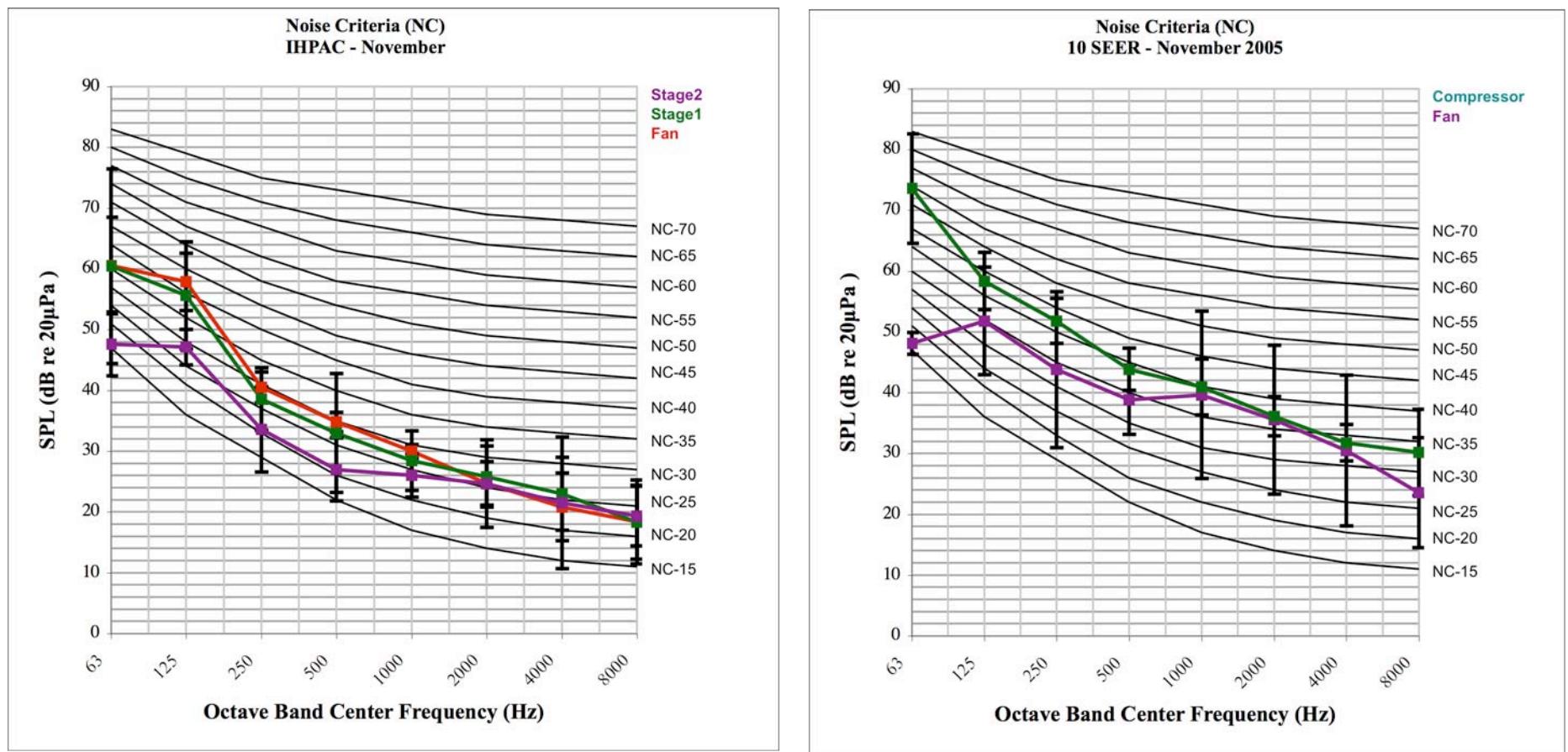


Figure A-7. Acoustic noise octave band distributions for average of six 10 SEER and ten IHPAC systems studied in Northern and Southern California in Fall 2005 operated with fan only and fan plus compressor modes. The error bars presented represent the minimum and maximum measured noise levels across the set of HVAC systems. Measurements were collected centered on the HVAC return plenum grille at a distance of 10 feet and at a height of 5 feet from the floor.

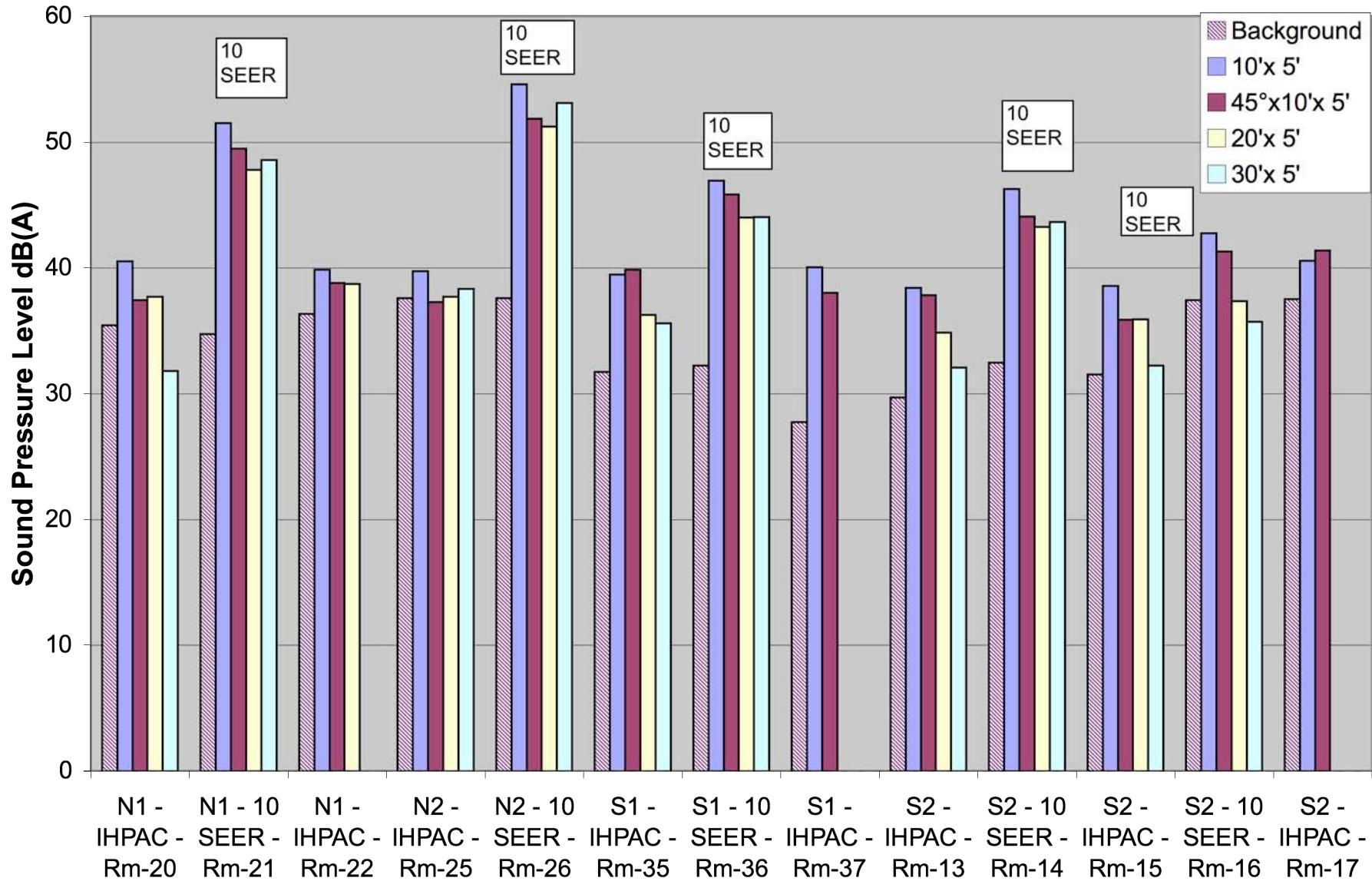


Figure A-8. Noise levels in unoccupied 10 SEER and IHPAC classrooms with fan only (background level not adjusted). Measurements were taken at indoor locations identified in the legend. Data are from the spring monitoring visits.

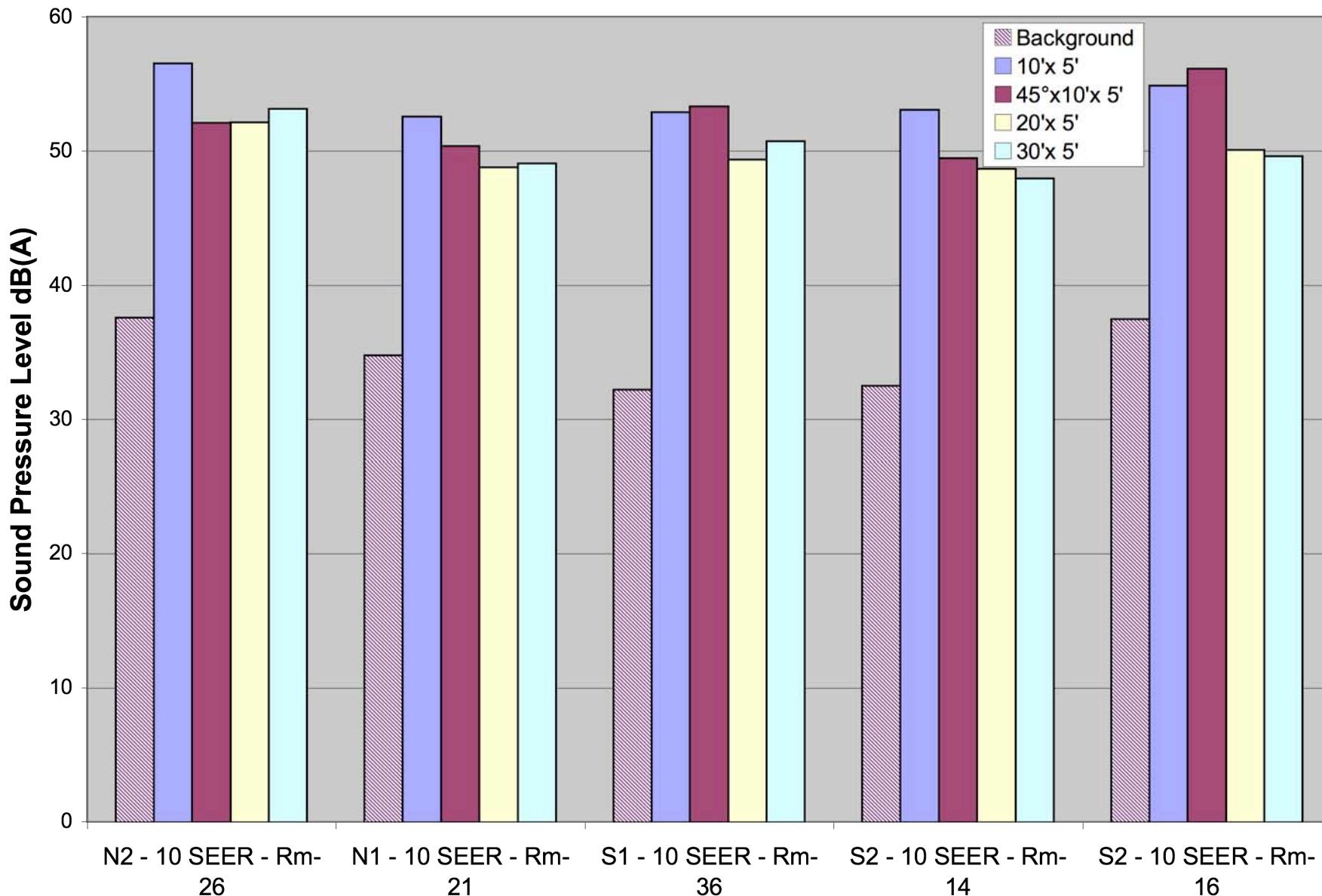


Figure A-9. Noise levels in unoccupied 10 SEER classrooms with fan and compressor on (background level not adjusted). Measurements were taken at indoor locations identified in the legend. Data are from the spring monitoring visits.

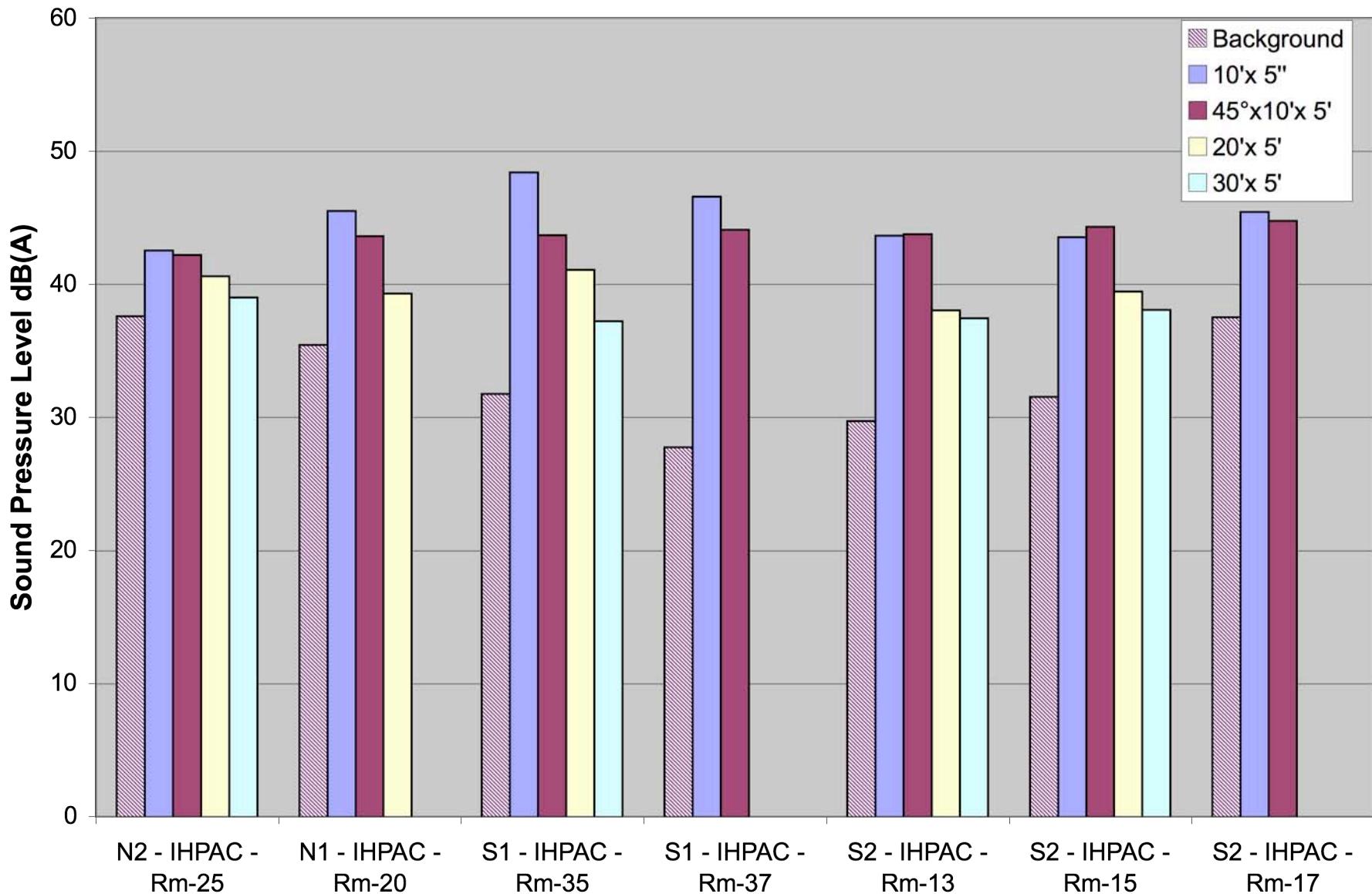


Figure A-10. Noise levels in unoccupied IHPAC classrooms with fan and compressor Stage 1 on (background level not adjusted). Measurements were taken at indoor locations identified in the legend. Data are from the spring monitoring visits.